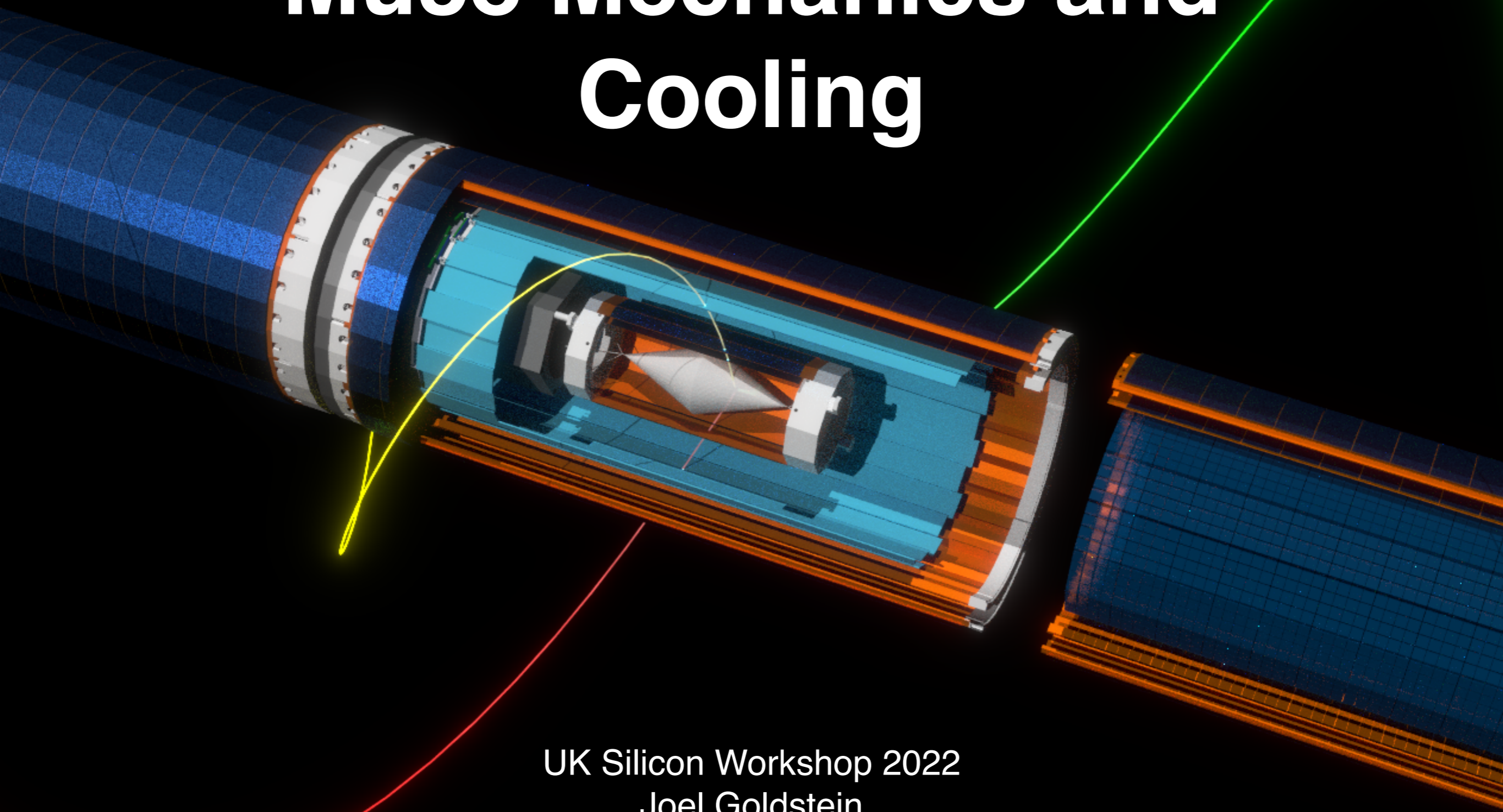


Mu3e Mechanics and Cooling



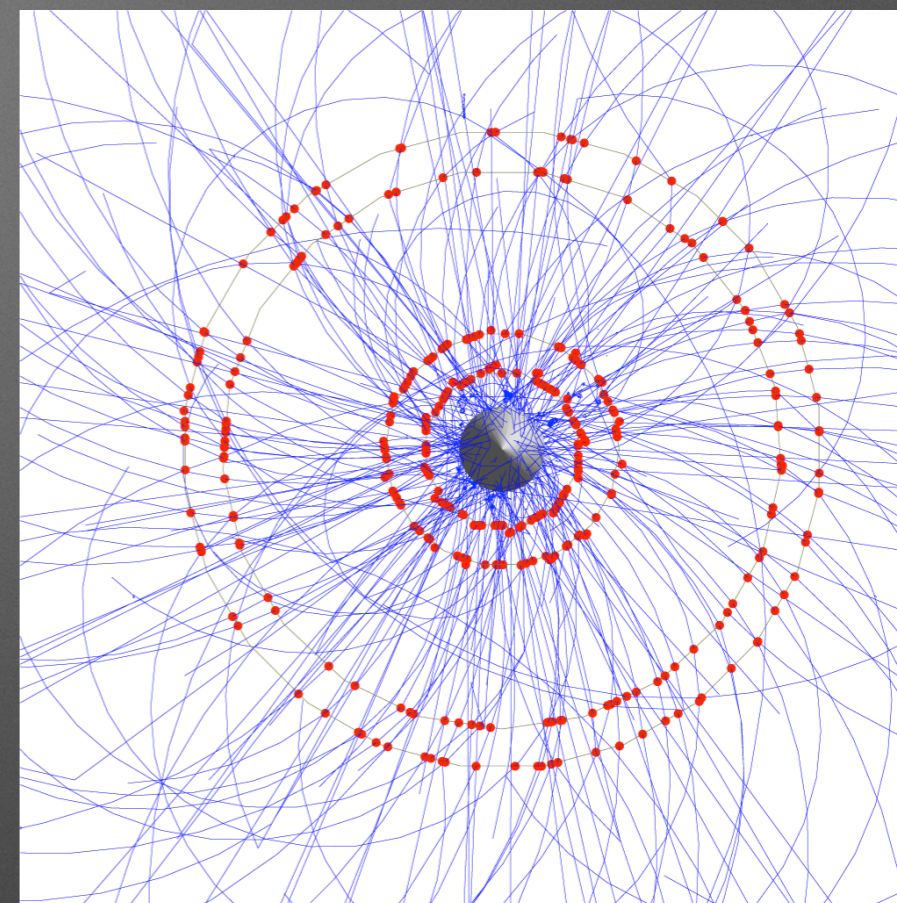
UK Silicon Workshop 2022
Joel Goldstein



Searching for $\mu \rightarrow eee$



- One decay in $10^{-12} \rightarrow 10^{-16}$:
 - Intense μ source $\geq 10^8/s$
- Coincident background:
 - Vertex resolution $\sim 200 \mu\text{m}$
 - Timing resolution $\sim 100 \text{ps}$
- Background from $ee\nu\nu$ (factor of $10^7 \rightarrow 10^{11}$)
 - Excellent momentum resolution for $\lesssim 50 \text{MeV}$ electrons
 - ***Minimum of material***

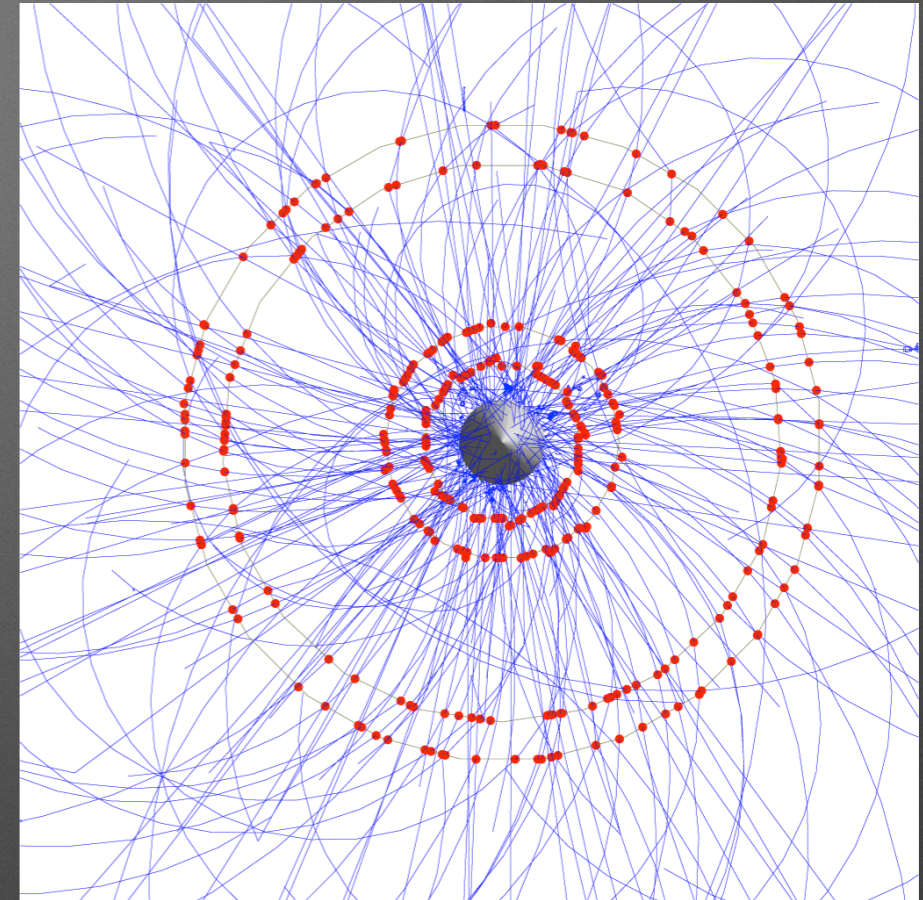




Searching for $\mu \rightarrow eee$

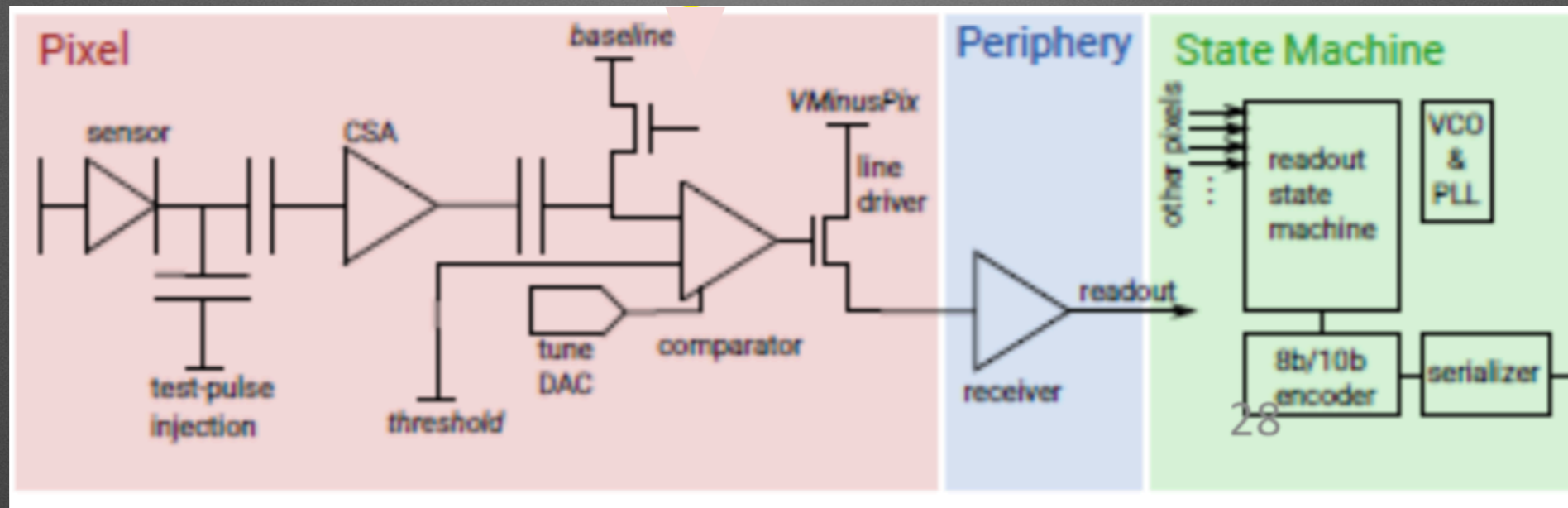


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MuPix



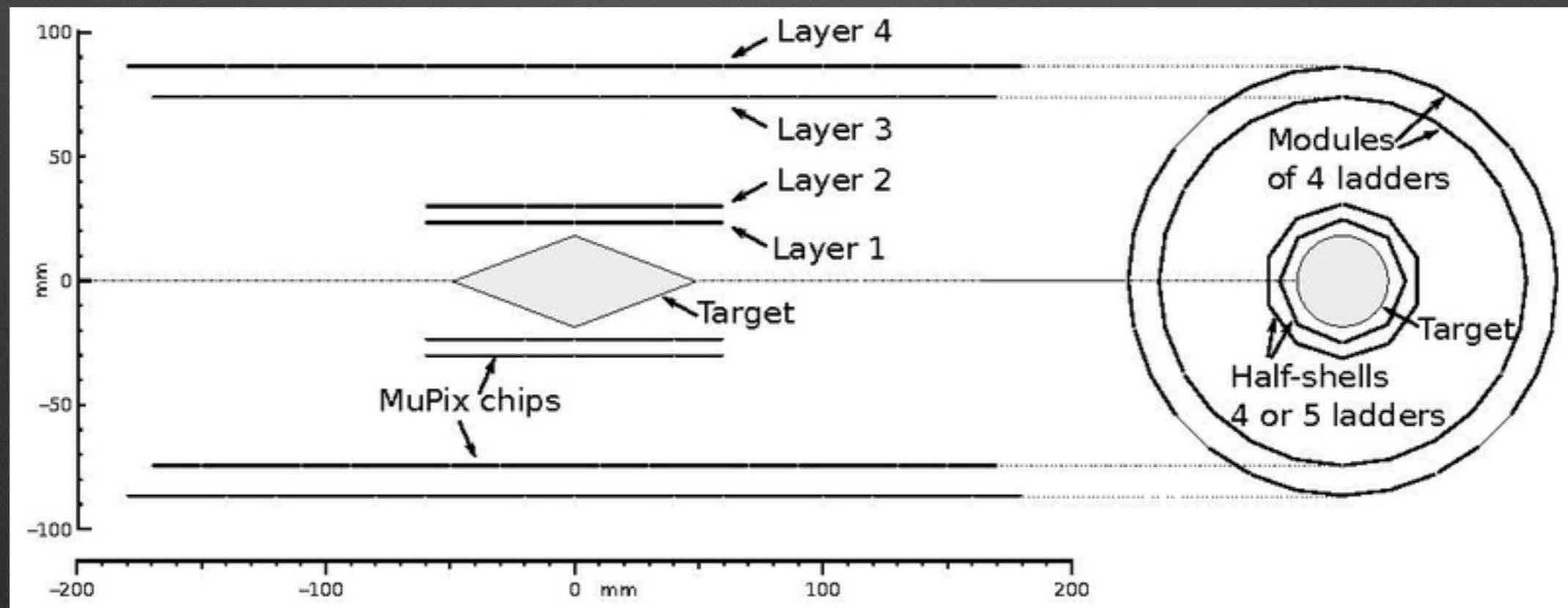
- Dedicated HV-MAPS (*closely related to ATLASPIX*)
- $80 \times 80 \mu\text{m}^2$ pixels with amplifier and comparator
- Asynchronous readout: *timestamp, TOT and address*
- Timing resolution ~ 20 ns
- Production version (MuPix11) now arriving



Pixel Detector

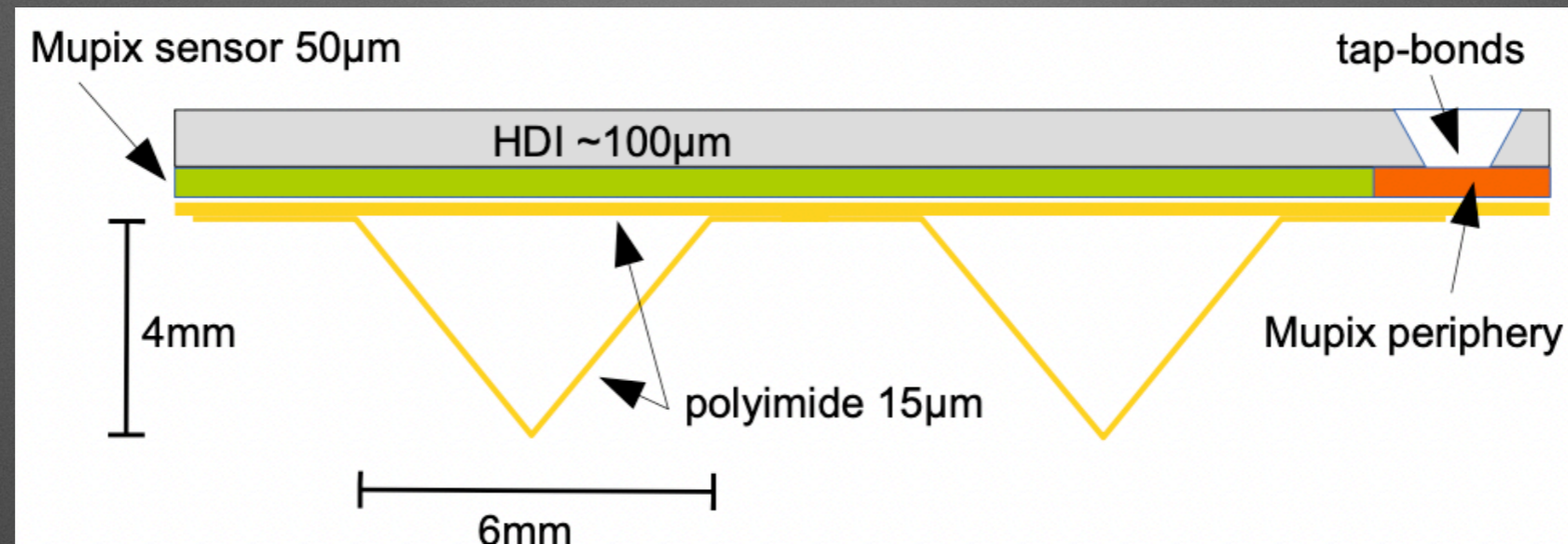


- Central station is 4-layer pixel tracker
- UK building outer two layers (Oxford, Liverpool, Bristol)
 - 0.35 m², 56 MPixels

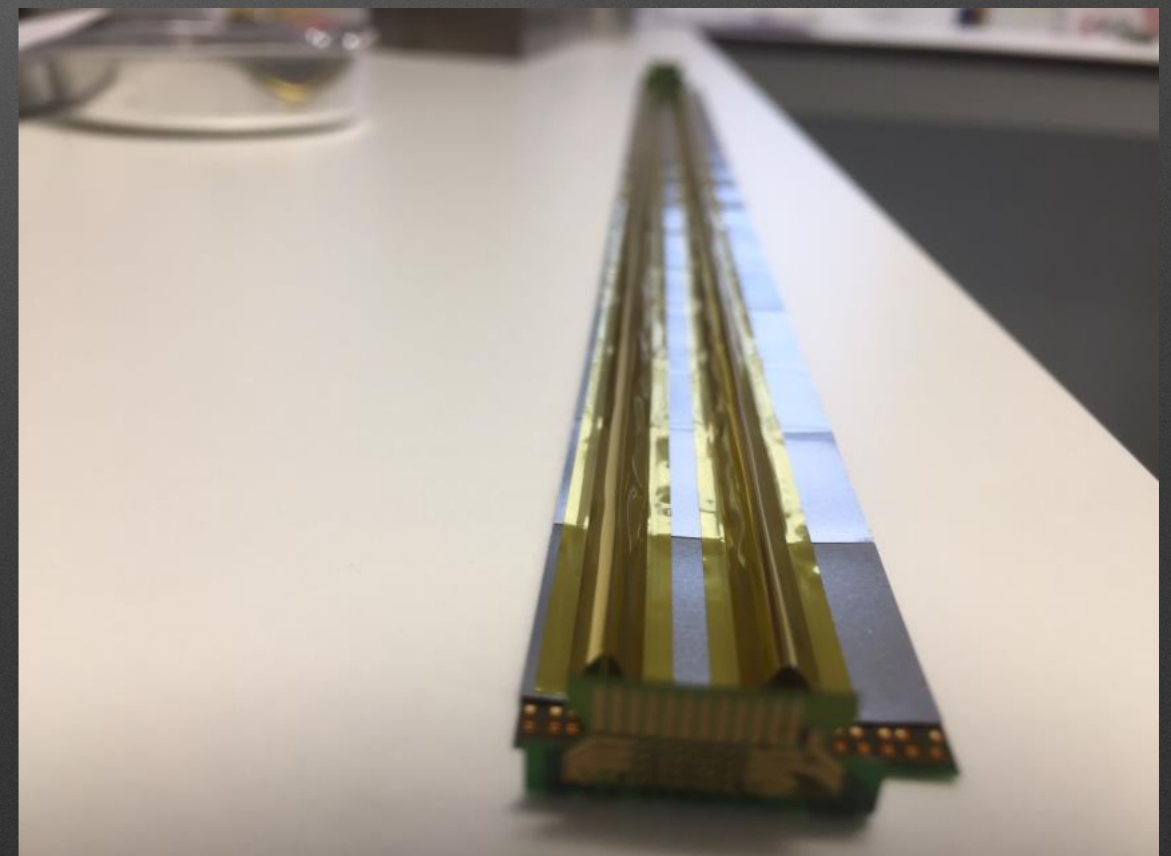




Pixel Ladders

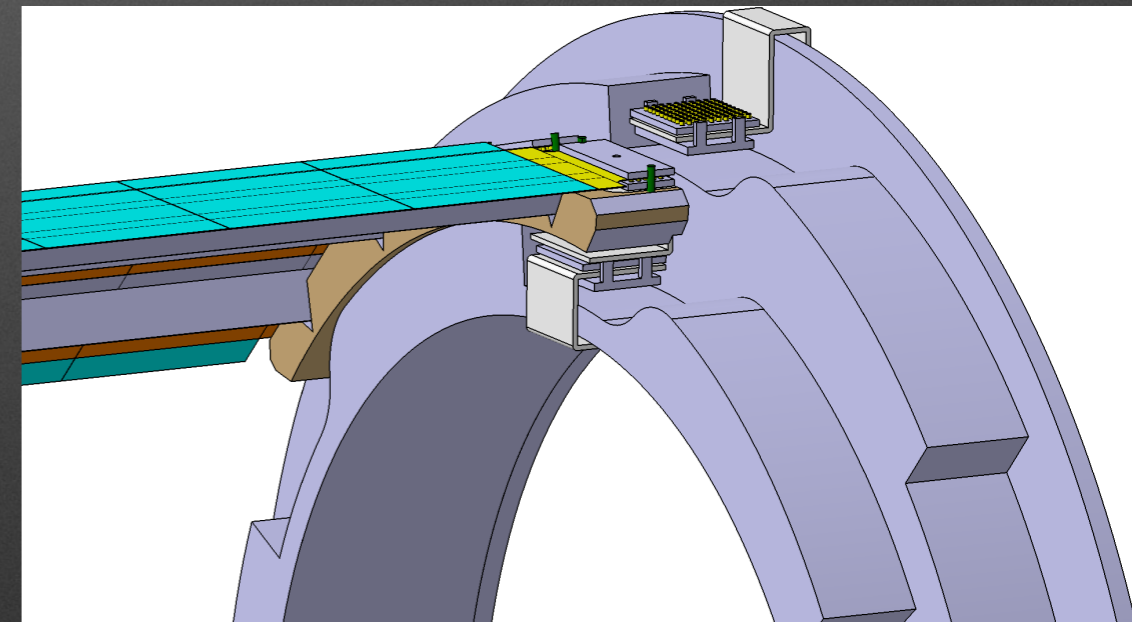
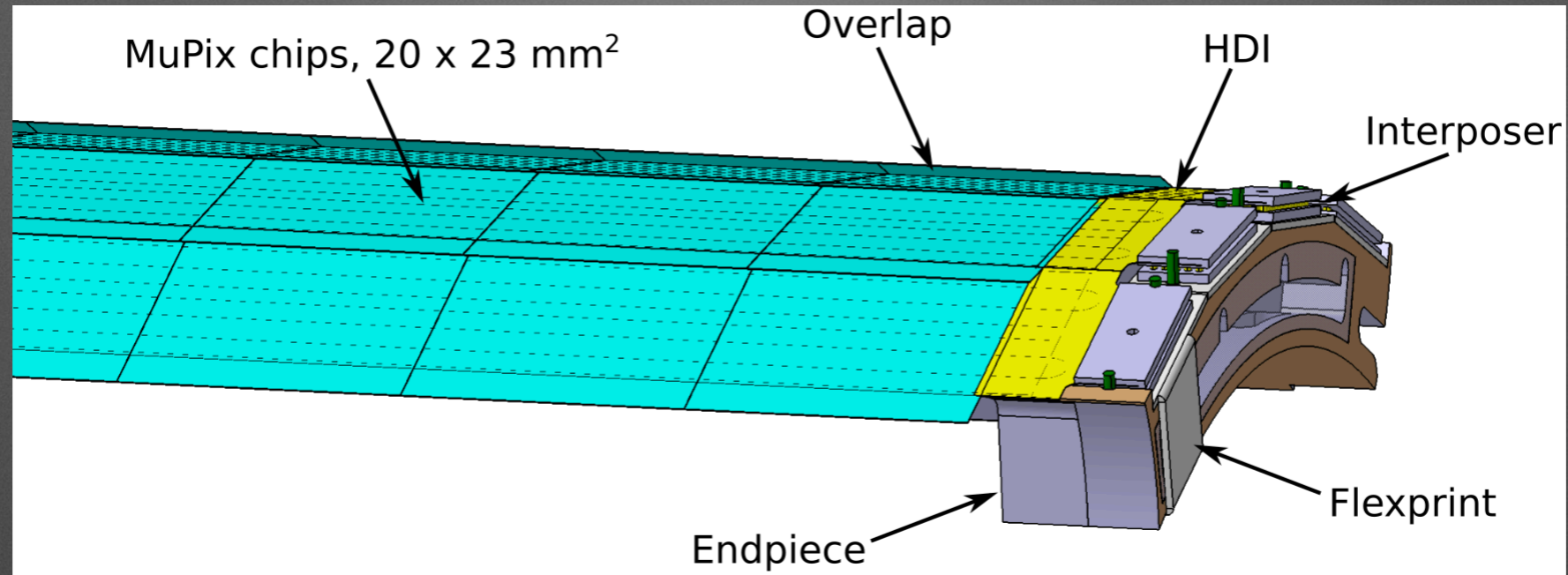


- Ladders 16/18 chips long
- Material 0.1 % X_0 per layer
 - Mupix chips thinned to 50 µm
 - TAB-bonded to ultra-thin kapton flex
 - Kapton v-fold support





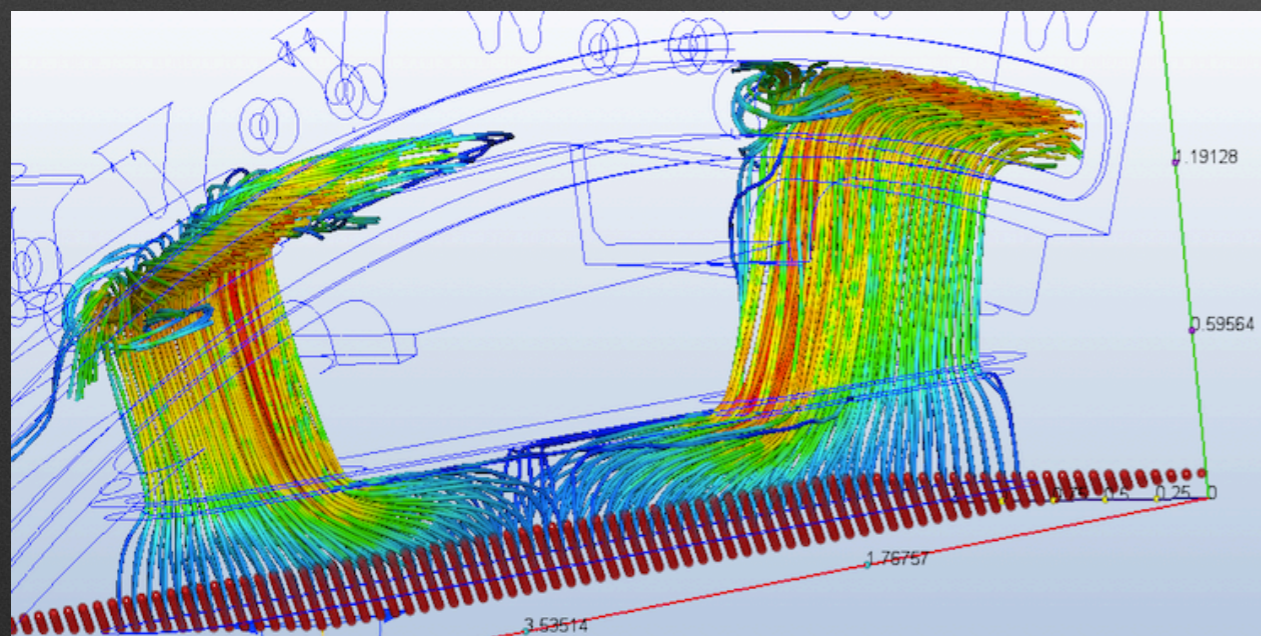
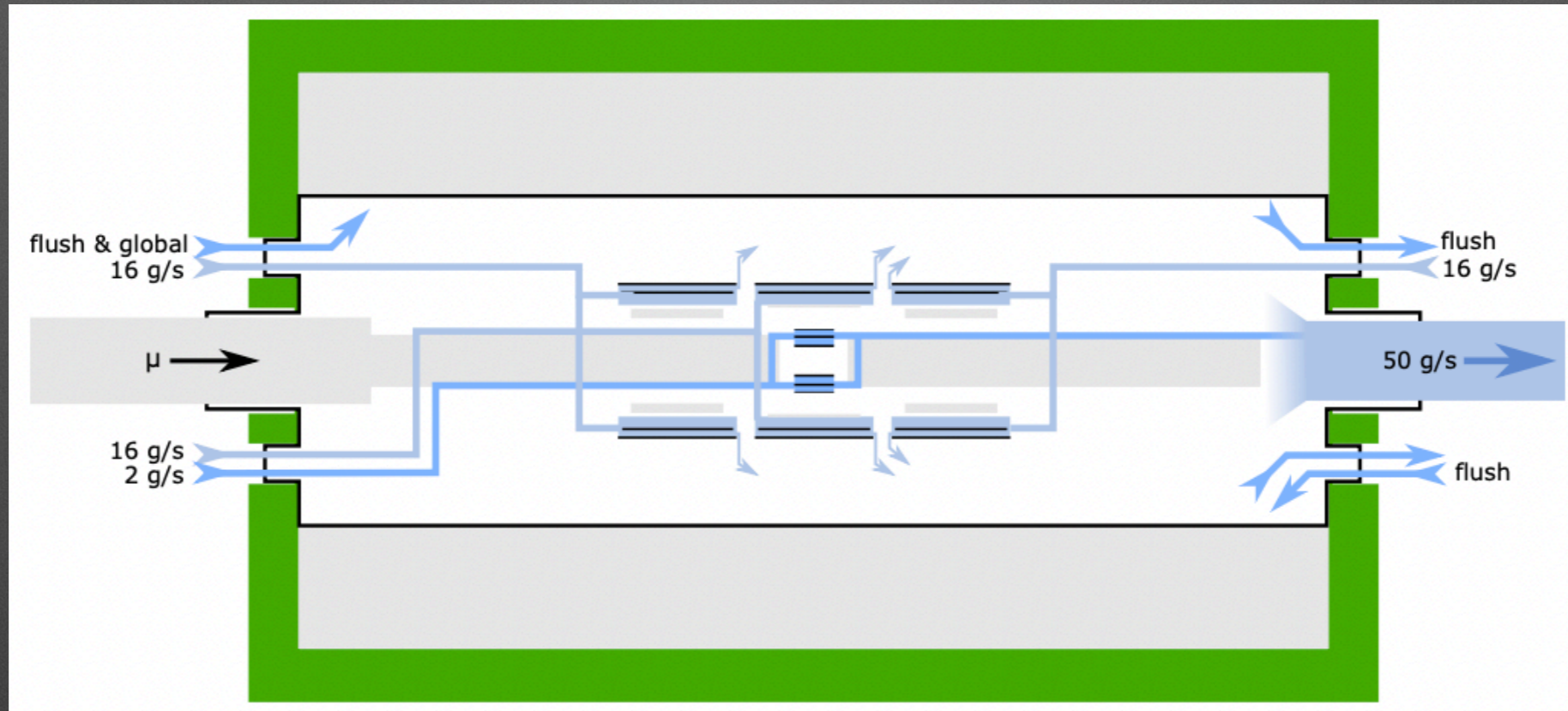
Pixel Modules



- Four ladders make a module
- Endpieces lock into endrings
 - Attached to cage/beampipe
 - One endring tensioned via springs



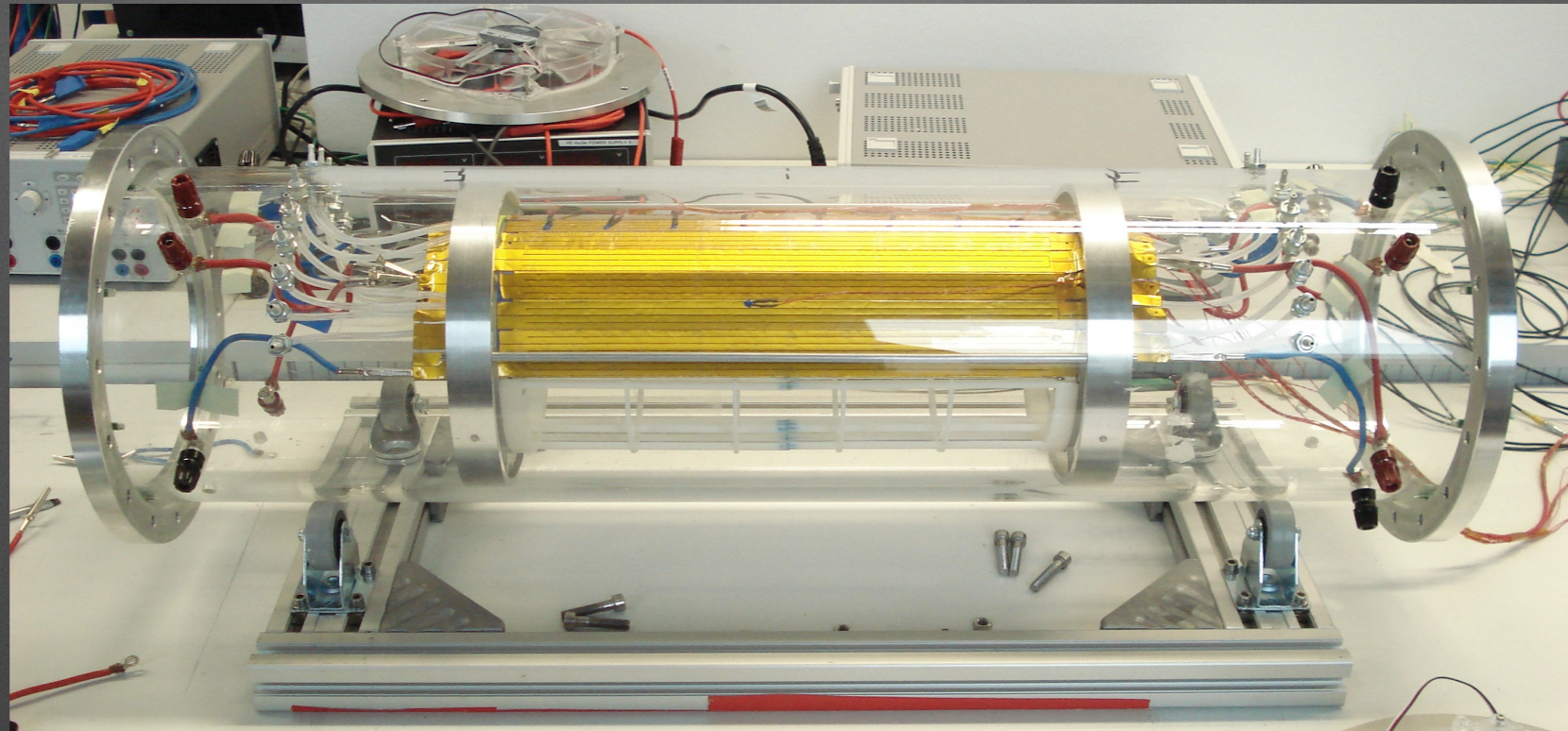
Cooling



- Max 4.5 kW heat generated
- 50° temperature gradient
- Gaseous helium cooling
- Supply through endrings/endpieces



Cooling Tests



- Various tests with resistive flexes/chips
 - Verify simulations
 - Experience with construction and handling

Backup